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A Fuzzy Compromise Programming Solution for Supplier Selection in Quantity Discounts Situation

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KEYWORDS

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Supply chain management,
Quantity discount.

ABSTRACT

Supplier selection is naturally a complex multi-objective problem including both quantitative and qualitative factors. This paper deals with this issue from a new view point. A quantity discount situation, which plays a role of motivator for buyer, is considered. Moreover, in order to find a reasonable compromise solution for this problem, at first a multi-objective modeling is presented. Then a proposed fuzzy compromise programming is utilized to determine marginal utility function for each criterion. Also, group decision makers' preferences have taken into account and the weight of each criterion has been measured by forming pair-wise comparison matrixes. Finally the proposed approach is conducted for a numerical example and its efficacy and efficiency are verified via this section. The results indicate that the proposed method expedites the generation of compromise solution.

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1. Introduction

Related to the first category, we can mention different research. Karpak et al.(2001) constructed a goal programming model [1]0. Ghodsypour et al.(2001) presented a mixed integer nonlinear programming [2]. Similarly, Xia and Wu (2007) integrated the approach of AHP, rough sets theory and multiple-objective mixed-integer programming [3]. Wadhwa et al.(2007) proposed a multi-objective programming and utilized weighted objective method, goal programming and compromise programming to compare results [4]. Lio and Rittscher (2007) developed a MODM model under stochastic demand situations and used Genetic Algorithm [5]. Rezaei and Davari (2008) dealt with the supplier selection and multi-item inventory management at the same time [6]. Ng (2008) developed a weighted linear programming [7]. According to the second category, we can point to some conducted studies. Yu and Tzeng (2006) attempted to cope with uncertainty by applying a fuzzy ANP method [8]. Demirtas and Üstün (2006) presented an integrated decision making process through applying ANP method [9]. Also, a fuzzy extended AHP-based methodology is presented by Chan and Kumar (2007) [10]. Ming-Lang et al.(2008) presented a method for selection of optimal suppliers by using ANP and Choquet integral approach [11]. Moreover, Sanayie et al.(2010) applied VIKOR method in order to cope with group decision making process [12]. Concerning the third category, we can refer to the variety of research. Chen et al.(2006) and Sarkar et al.(2006) presented hierarchy model based on fuzzy sets theory and expressed linguistic values in trapezoidal and triangular fuzzy numbers [13,14]. Amid et al.(2006) suggested a developed fuzzy multi-objective linear programming [15]. Onut et al.(2008) applied the analytical network process (ANP) and utilized triangular fuzzy numbers [16]. Wua et al. (2010), proposed a fuzzy multi-objective programming model to take suppliers' risk factors into account [17]. Xu and Nozick (2009), formulated a two-stage stochastic programming in order to deal with the loss

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of production capability at suppliers'sites [18]. Besides, It is possible to cluster various research based on the forth category. Ding et al.(2005) proposed a Genetic Algorithm based optimization methodology [19]. Sadeghi Moghaddam et al.(2008) proposed a hybrid intelligent genetic algorithm in order to forecast the rate of demand, determining the material planning and selecting suppliers simultaneously [20]. Moreover, some research can be incorporated in the separated category on the title of "other method".

For instance, Weber et al.(2000) presented an approach indicated on using multiple objective programming for supplier selection and then assessed suppliers' efficiency by applying DEA method [21]. Talluri (2002), developed a famous chance-constrained DEA approach [22]. Berger et al.(2004) applied a decision tree approach to determine the optimal number of suppliers [23]. Correspondingly, Seydel (2006), Saen (2006) and Ross et al. (2006) tackled with the supplier selection problem by using DEA method and considered both buyer and supplier's performance attributes [24-26]. Hu Chang-Ying (2009) developed a bi-level programming model between the manufacture and the supplier and presented a solution through dynamic programming [27].

Tab. 1. Supplier selection approaches and examples.

Category	Approach	Example
Mathematical programming	MODM	[3,4,5,17]
	MIP(Mixed Integer Programming)	[2,3,6]
	LP	[7]
	Goal Programming	[1]
MADM	AHP	[10,13,14]
	ANP	[8,11,16]
	VIKOR	[12]
Meta-heuristics	Genetic Algorithm	[5,19,20]
Approaches which deal with uncertainty	Fuzzy Approach	[8,9, 10, 13, 14, 15, 16, 17]
	Stochastic Programming	[18]
Other methods	DEA	[21, 22, 24, 25, 26]
	Decision tree approach	[23]
	Dynamic Programming	[27]

2. Problem Description

Studying the related literature review accurately, implies that up to now just few papers have focused on supplier selection in quantity discounts situation. In this paper, we deal with supplier selection issue from the perspective of determining economic order splitting among various suppliers in a situation in which a number of items are to be prepared from multi-supplier offering different price lists considering quantity discount. In order to achieve an efficient solution toward this problem, a multi-objective linear programming (MOLP) model has been implemented corresponding the critical criteria for selecting and evaluating suppliers. The contribution is that MOLP model includes a set of goals that have simultaneous trade-off and in this article, unlike the studies which attempt to scale the MOLP problem down to the Mixed Integer Programming and neglect to consider scaling and subjective weighting issues; we utilize a fuzzy compromise programming to determine marginal utility function for each criteria. Furthermore, Geometric mean operator is used to aggregate the opinions of different decision makers and measure the weight of each criterion via forming pair-wise comparison matrixes.

By applying the proposed procedure, the corresponding order quantity for each supplier based on the optimized solution will be generated. The rest of the paper is organized as follows: Section 3 is related to the Mathematical formulations of the supplier selection model under multi-supplier with different quantity discounts. Section 4 describes the solution method and entails different parts: concepts of fuzzy compromise programming approach, measuring the weights of criteria, choosing a suitable aggregate operator to determine a degree of global utility function, reformulating the MOLP into a fuzzy compromise programming model and finding the corresponding order quantity for each supplier. In Section 5 a numerical example with solution is presented in order to illustrate the efficacy and efficiency of the proposed approach. Finally, in section 6 some conclusions and future research are presented.

3. Mathematical Model for Supplier Selection Problem

In this section, mathematical model of the supplier selection decision under the conditions of a multi-supplier quantity discount is formed. To develop the proposed model, we adopt the following assumptions and notations.

3.1. Assumptions

- In this model, supply chain has two echelons and entails multi-suppliers, single product and one buyer.
- Each supplier has a definite and limited capacity.
- Each supplier offer a price list considering quantity discount in order to motivate buyer for buying more amounts of product.
- The delivery lateness rate per unit from each supplier is definite.
- The amount of buyer's demand is definite.
- The average defective rate per unit from each supplier is definite.
- The total quantity of the item ordered from all selected suppliers meets the quantity demanded during the planning horizon.

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3.2. Notations

n	The number of suppliers.
D	The buyer's demand.
s	The number of criteria (objective functions).
l_i	The delivery lateness rate per unit of i[th] supplier.
d_i	The average defective rate per unit from i[th] supplier.
k_i	The maximum capacity of i[th] supplier.
$p_{i,j}$	The unit price of i[th] supplier at j[th] price level.
$q_{i,j}$	The j[th] price level of i[th] supplier, $i=1,2,...,n$, $j=1,2,...,m(i)$.
$c^s_{i,j}$	The coefficient of the s[th] objective function from i[th] supplier at j[th] price level, $s=1,2,...,S$.
$U(.)$	Global utility for MOLP.
$U_s(.)$	Marginal utility of s[th] criterion.
w_s	The weight of s[th] criterion.
$x_{i,j}$	The amount of units which is ordered from i[th] supplier at j[th] price level by buyer.(decision variable)
$y_{i,j}$	Binary variable, It is equal 1 when the i[th] supplier is selected at j[th] price level, Otherwise it is equal 0.(decision variable)
Z_s	The objective function of s[th] criterion.
$Z_s^{\min}$	Minimum value for s[th] objective function.
Z_s^{Nadir}	An upper bound for non-dominated solutions in problems which minimize objectives and a lower bound for non-dominated solutions in problems which maximize objectives.

3.3. Objective Functions (General Form)

$$\begin{aligned} MinZ_1 &= \sum_{i=1}^{n}\sum_{j=1}^{m(i)} c^1_{i,j}x_{i,j} \\ MinZ_2 &= \sum_{i=1}^{n}\sum_{j=1}^{m(i)} c^2_{i,j}x_{i,j} \\ &\vdots \\ MinZ_s &= \sum_{i=1}^{n}\sum_{j=1}^{m(i)} c^s_{i,j}x_{i,j} \end{aligned} \quad (1)$$

$$S.t. \quad (2)$$

$$\sum_{i=1}^{n}\sum_{j=1}^{m(i)} x_{i,j} = D$$

$$\sum_{j=1}^{m(i)} x_{i,j} \le k_i \qquad \forall i: i=1,2,...,n \quad (3)$$

$$q_{i,j-1}y_{i,j} \le x_{i,j} \le q_{i,j}y_{i,j} \qquad \forall i: i=1,2,...,n,\ \forall j: j=1,2,...,m(i) \quad (4)$$

$$y_{i,j}\begin{cases}1 & \text{if } x_{i,j}>0\\ 0 & \text{if } x_{i,j}=0\end{cases} \qquad \forall i: i=1,2,...,n,\ \forall j: j=1,2,...,m(i) \quad (5)$$

$$\sum_{j=1}^{m(i)} y_{i,j} \le 1 \qquad \forall i: i=1,2,...,n \quad (6)$$

$$x_{i,j} \ge 0 \qquad \forall i: i=1,2,...,n,\ \forall j: j=1,2,...,m(i) \quad (7)$$

Related to the Equation 1, Z_1, Z_2,…, Z_s sequentially demonstrate the s[th] individual objective function. Decision maker tends to optimize all of the objective functions simultaneously.

In this general form of objective functions, if an objective function is to be maximized, it can be converted into the minimization through utilizing a method like multiplying -1 by the objective function. In this paper, we define the three objective functions for minimizing cost, defective rates, and delivery lateness for amounts of product which are purchased from various suppliers.

Equation 2 guarantees that the total quantity of the product which is ordered from all selected suppliers meets the quantity demanded during the definite planning horizon.Equation 3 indicates on this matter that Suppliers have limited capacities. Equation 4 is related to the quantity discount range constraints. The sequence of quantities at which price breaks occur, can be represented by $0=q_{i,0}\le q_{i,1}\le\cdots\le q_{i,m(i)}=\infty$ and the number of quantity ranges in i[th] supplier's price level has been shown via m (i). The binary nature of supplier selection decision has considered in Equation 5. Furthermore, Equation 6 implies that the price level per supplier among which can be chosen is only one or none. Besides, forbidding negative orders has been satisfied through Equation7. Regarding this multi-objective model, developing an optimal solution seems difficult.

Moreover, it is somehow impossible or impractical to generate the entire sets of non-dominated solutions because when the dimension and size of problem increase, the number of pareto solutions will raise exponentially.

Therefore, as it will be described in the next section, we utilize a fuzzy compromise programming approach to solve this model and convert MODM problem to a single objective problem.

4. Solution Method

In this study, the concept of optimal compromise solution besides fuzzy approach which applied by Li *et al.*(2000) [28] toward a multi-objective transportation problem will be utilized to achieve a more reasonable compromise solution for allocating order quantities

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among suppliers offering various quantity discount rates. In other words, at first a fuzzy approach to MOLP will be introduced in order to obtain the degree of marginal utility for each objective. Secondly, by applying a proper combination of decision-making parameters, these degrees of marginal utility can be aggregated in order to achieve a global utility for all objectives. Thirdly, on the basis of obtained global utility, it will be possible to form a fuzzy compromise programming approach toward MOLP problem.

4.1. Fuzzy Compromise Programming

According to this consideration that the value of each objective function Z_s changes linearly from $Z_s^{\min}$ to Z_s^{Nadir} (which obtain by solving the MOLP problem as a single objective (while ignoring the other objectives) and forming a pay-off table for all objective functions), it is possible to take into account this value as a fuzzy number with a linear membership function based on preference or utility. Also, the membership function of each objective utility can be defined by Equation 8.

$$U_s(x)=\begin{cases}1 & if Z_s(x)\le Z_s^{\min}\\ \dfrac{Z_s(x)-Z_s^{Nadir}}{Z_s^{\min}-Z_s^{Nadir}} & if Z_s^{\min}<Z_s(x)\le Z_s^{Nadir}\\ 0 & if Z_s(x)>Z_s^{Nadir}\end{cases} \quad (8)$$

Moreover, we can define the degree of global utility $U^{\alpha}(x)$ of the MOLP problem as Equation 9.

$$U^{\alpha}(x)=\left(\sum_{s=1}^{S} w_s U_s^{\alpha}(x)\right)^{1/\alpha} \quad \text{Where} \quad 0<|\alpha|<\infty,\ \sum_{s=1}^{S} w_s=1 \quad (9)$$

In Equation 9, α is a parameter and its value is determine in accordance with preference of decision makers. In practical perspective, normally two aggregation operators are applied to deal with the MOLP problem. One of them maximizes the total utility expressed in terms of considering the sum of the utility of objectives and is defined as a weighted additive operator ($\alpha=1$). The other operator maximizes the least utility among all objectives, which is defined as a max–min operator ($\alpha=-\infty$) [29]. Moreover, w_s represents the weight of s^{th} criterion and demonstrates the decision makers' preferences over the relative importance among the objectives and the way of its calculation will be discussed in the next section. Thus, the MOLP problem stated in Equation 1 to Equation 7, can be formulated as the following fuzzy compromise programming problem (Equation 10).

$$\text{Maximize } U^{\alpha}(x)=\left(\sum_{s=1}^{S} w_s U_s^{\alpha}(x)\right)^{1/\alpha} \quad (10)$$

$$\text{S.t. } X$$

The advantage of this form of modeling is that the MOLP problem has converted to a single objective programming problem and the ordinary optimization techniques can be used to solve it.

Let $x^* \in X$ be an optimal solution for this model (Equation 10).

That is $U^{\alpha}(x^*)=\max U^{\alpha}(x):\ (x\in X)$. x^* is a non-dominated (pareto) compromise solution in which the synthetic membership degree of optimum for all objectives is maximal. In this paper, it is assumed that there are some decision makers who state their opinion toward the relative importance of criteria in pair-wise comparison matrixes. Then the Geometric mean operator is utilized to in order to aggregate the decision makers' opinion and Saaty's heuristic method is applied to calculate the weights' of each criterion in the next section.

4.2. Measuring the Weights of Criteria

Choosing critical and important criteria in order to identify the supplier performance has a fundamental role in selecting suppliers effectively.

Furthermore, strategies underlying alliance between a buyer and suppliers can be classified into five levels: Temporary basic relationship, Temporary operational relationship, Cyclical operational relationship, Long lasting tactical relationship, Long lasting strategic relationship.

In this paper, we have considered the Temporary operational relationship and deal with price, quality and delivery performance as three important criteria for selecting suppliers and formulating corresponding three objective functions. In this section in order to obtain weights of criteria, it is supposed that there are L decision makers (DMs) who have similar importance.

They state their opinion toward relative importance of criteria via pair-wise comparison matrix. Let $V=\{v_1,v_2,...,v_s\}$ be a set of criteria. Each decision maker's pair-wise comparison matrix (which is a reciprocal matrix) can be defined as Equation 11. Also, Table 2 demonstrates the measurement scale which is used for verbal judgment or preference of DMs.

$$A=\begin{bmatrix} a_{1,1} & \cdots & a_{1,s}\\ \vdots & a_{i',j'} & \vdots\\ a_{s,1} & \cdots & a_{s,s}\end{bmatrix} \quad \text{where } a_{i',j'}=\frac{1}{a_{j',i'}} \text{ for all } i',j'=1,2,...,s \quad (11)$$

Tab. 2. Measurement scale for Verbal judgment [8]

Verbal judgment or preference	Numerical rating
Extremely preferred	9
Very strongly preferred	7
Strongly preferred	5
Moderately preferred	3
Equally preferred	1

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Moreover in order to aggregate DMs' opinion, Geometric mean operator is applied and a single matrix is formed (Equation 12).

$$A' = \begin{bmatrix} a'_{1,1} & \cdots & a'_{1,s} \\ \vdots & a'_{i',j'} & \vdots \\ a'_{s,1} & \cdots & a'_{s,s} \end{bmatrix} \quad (12)$$

where $a'_{i',j'} = (\prod_{l=1}^{L} a_{i',j'})^{\frac{1}{L}}$

for all $i', j' = 1, 2, ..., s$ and $l = 1, 2, ..., L$

Furthermore, in order to calculate the weights of criteria, referring to Saaty's theorem [30] that is shown by Equation 13 and his proposed heuristic method, for each row of matrix A' the sum of elements is obtained and the weights are computed.

$$\vec{W} = \lim_{k \to \infty} \frac{A^K . e}{e^T . A^K . e} \quad (13)$$

Where A is a pair-wise matrix, $\vec{W}$ is the normalized principal right eigenvector of matrix A and $e^T = (1, ..., 1)$.

Therefore, after computing the weights of criteria, every parameters in the fuzzy compromise programming which has shown in Equation 10 will be definite and Equation 14 indicates on the extended form of this model (when the value of α is assumed equal 1. $\alpha = 1$)

Maximize

$$U(x) = \sum_{s=1}^{S} w_s \frac{Z_s(x) - Z_s^{Nadir}}{Z_s^{\min} - Z_s^{Nadir}}$$

$$= \sum_{s=1}^{S} w_s \frac{\sum_{i=1}^{n} \sum_{j=1}^{m(i)} c_{i,j}^s x_{i,j} - Z_s^{Nadir}}{Z_s^{\min} - Z_s^{Nadir}}$$

$$= \sum_{i=1}^{n} \sum_{j=1}^{m(i)} (\sum_{s=1}^{S} \frac{w_s c_{i,j}^s}{Z_s^{\min} - Z_s^{Nadir}}) x_{i,j} - \sum_{s=1}^{S} \frac{w_s Z_s^{Nadir}}{Z_s^{\min} - Z_s^{Nadir}}$$

S.t. X (14)

In the next section, the proposed solution is applied for the some part of data set extracted from a study presented by Weber and Desai *et al* [31]. which is related to the supplier selection process in a pharmaceutical company.

5. Numerical Example

A pharmaceutical company tends to define the amount of order for definite products considering various price lists which are offered by two suppliers. In this case study, buyer would prefer to minimize costs, delivery lateness and defective rate of purchased products. Also, it is evaluated that the demand of buyer (pharmaceutical company) during a definite planning horizon is equal 1,200,000 units of product. The supplier's quantity discount price lists are as the following tables:

Tab. 3. Defective rate, delivery lateness rate and limited capacity of each supplier.

	Defective rate per unit of product	Delivery lateness rate per unit of product	Capacity during a definite planning horizon
Supplier 1	1.20%	5.00%	2,400,000 units
Supplier 2	0.80%	7.00%	360,000 units

5.1. Step 1.

At first the MODM problem is formulated. After modeling this problem as is illustrated in the appendix section, Lingo software is employed to form the pay-off table related to the three objective functions. The result of this stage is shown in Table 5.(Each column is related to the different value of objective Z_s by setting the optimum solution of other objective functions, also the minimum value of each objective function (disregarding other objective functions) has been bold.)

Tab. 4. Quantity discount price lists of each supplier.

	Amount of order	Price per unit
Suppliers1	If (0<=Amount of order<100,000) then	0.1990
	Else if (100,000<=Amount of order <1000,000) then	0.1980
	Else (Amount of order>=1000,000).	0.1958
Suppliers 2	If (0<=Amount of order<200,000) then	0.1890
	Else (Amount of order>=200,000).	0.1881

Tab. 5. Pay-off among objective functions.

	Z_1	Z_2	Z_3
$Z_1^{\min}$	**232188**	12960	67200
$Z_2^{\min}$	232188	**12960**	67200
$Z_3^{\min}$	234960	14400	**60000**

Considering the result of Table 5, we can identify the values of Z_s^{Nadir} for s=1, 2, 3 as below:

$$Z_1^{Nadir} = 234960, Z_2^{Nadir} = 14400, Z_3^{Nadir} = 67200$$

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5.2. Step 2.
In this stage the marginal utility of each criterion is formed.

$$U_1(x)=\begin{cases}1 & Z_1(x)\le 232188\\ \dfrac{Z_1(x)-234960}{232188-234960} & 232188<Z_1(x)\le 235620\\ 0 & Z_1(x)>235620\end{cases}$$

$$U_2(x)=\begin{cases}1 & Z_2(x)\le 12960\\ \dfrac{Z_2(x)-14400}{12960-14400} & 12960<Z_2(x)\le 13600\\ 0 & Z_2(x)>13600\end{cases}$$

$$U_3(x)=\begin{cases}1 & Z_3(x)\le 64000\\ \dfrac{Z_1(x)-67200}{60000-67200} & 64000<Z_3(x)\le 67200\\ 0 & Z_3(x)>67200\end{cases}$$

5.3. Step 3.
In this stage the pair-wise comparison matrixes related to the three criteria are obtained through collecting three decision makers' opinion (Equation 12). Also, the Geometric mean operator is utilized to aggregate their preferences. (In the pair-wise matrixes, s^{th} Criterion (for s=1, 2, 3) indicates on price, delivery and quality of product, in order.) Besides, the weights of criteria are calculated based on the Equation 14.

$$A_1=\begin{bmatrix}1 & 4 & 3\\ \frac{1}{4} & 1 & 6\\ \frac{1}{3} & \frac{1}{6} & 1\end{bmatrix}\quad A_2=\begin{bmatrix}1 & \frac{1}{2} & \frac{1}{4}\\ 2 & 1 & \frac{1}{4}\\ 4 & 4 & 1\end{bmatrix}$$

$$A_3=\begin{bmatrix}1 & 3 & 4\\ \frac{1}{3} & 1 & \frac{1}{4}\\ \frac{1}{4} & 4 & 1\end{bmatrix}\quad A_{aggregation}=\begin{bmatrix}0.707 & 2.213 & 1.732\\ 0.452 & 1 & 0.93\\ 0.578 & 1.075 & 1\end{bmatrix}$$

w_1=0.480 w_2=0.247 w_3=0.273 $\qquad \sum_{s=1}^{S} w_s = 1$

5.4. Step 4.
In this stage by assuming $\alpha = 1$ (Using weighted additive operator), the global utility in accordance with Equation 15 is formulated and the fuzzy compromise programming model is constructed. Moreover, the final results related to this model are generated by applying lingo software and illustrated in Table 6.

$$MaximizeU(x)=\sum_{s=1}^{S} w_s \frac{Z_s(x)-Z_s^{Nadir}}{Z_s^{\min}-Z_s^{Nadir}}$$

$$=\sum_{s=1}^{S} w_s \frac{\sum_{i=1}^{n}\sum_{j=1}^{m(i)} c_{i,j}^{s} x_{i,j}-Z_s^{Nadir}}{Z_s^{\min}-Z_s^{Nadir}}$$

$$=\frac{0.48}{232188-234960}\sum_{i=1}^{2}\sum_{j=1}^{m(i)} p_{i.j}x_{i,j}+\frac{0.247}{12960-14400}\sum_{i=1}^{2}\sum_{j=1}^{m(i)} d_i x_{i,j}$$

$$+\frac{0.273}{60000-67200}\sum_{i=1}^{2}\sum_{j=1}^{m(i)} l_i x_{i,j}-\sum_{s=1}^{3}\frac{w_s Z_s^{Nadir}}{Z_s^{\min}-Z_s^{Nadir}}$$

$$=\left\{\begin{matrix}-1.73*10^{-4}(0.1990x_{11}+0.1980x_{12}+\\ 0.1958x_{13}+0.1890x_{21}+0.1881x_{22})\end{matrix}\right\}+$$

$$\left\{-1.71*10^{-4}(0.012(x_{11}+x_{12}+x_{13})+0.008(x_{21}+x_{22}))\right\}+$$

$$\left\{-3.79*10^{-5}(0.05(x_{11}+x_{12}+x_{13})+0.07(x_{21}+x_{22}))\right\}+45.7$$

S.t. x

Tab. 6. Final results

Variable	**U(x)**	x_{11}	x_{12}	x_{13}	x_{21}	x_{22}
Value	0.768	0	0	840,000	0	360,000
Variable	Z_1	Z_2	Z_3	U_1	U_2	U_3
Value	232188	12960	67200	1	1	0

According to the achieved results, it is obvious that the buyer must divide the amount of order between the two suppliers and choose the third category of first supplier's price list and second category of the second supplier's price list. The efficacy of the proposed model can be more obvious in the large scale problems that finding a solution for this MODM problem seems difficult. In the next section, we will deal with the entire conclusion and shed light on some future researches.

6. Conclusions and Future Research

In order to increase the competitive advantage and satisfy customers' requirements, many companies and enterprises consider the supplier selection problem as an important issue. As a matter of fact, the supplier selection is often influenced by uncertainty and

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naturally is a complicated multi-objective problem. In this paper, we attempted to take the quantity discount into consideration. We proposed a multi-objective linear programming and utilized a fuzzy compromise programming in order to convert this problem to a single objective model and incorporate the weights of objectives through various decision makers' opinion. Also, the proposed solution conducted for a numerical example and the result show that the presented approach is flexible and the fuzzy compromise programming facilitates the generation of compromise solution. Furthermore, we have incorporated group decision makers 'efficiently. Future studies of supplier selection procedures can be dealt with solving the proposed model by Meta-heuristic algorithms or developing this mathematical model by considering the risk of sourcing.

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